National Aeronautics and Space Administration

# NAC HEO Committee Report November 30, 2016

N. Wayne Hale | Interim Chair | NAC HEO Committee

# NAC HEO Committee Members

- Mr. N. Wayne Hale
  (Interim Chair)
- Ms. Nancy Ann Budden*
  (Vice Chair)
- Dr. Leroy Chiao
- Dr. Pat Condon
- Mr. Tommy Holloway
- Mr. Lon Levin+
- Dr. David Longnecker+
- Mr. Michael Lopez-Alegria
- Ms. Ruth Gardner
- Mr. Gerald Smith+
- Dr. Pat Sanders
  ( ASAP Chair)
- Mr. Joe Cuzzupoli
- Mr. Bob Sieck
- Ms. Shannon Bartell
- Mr. Jim Voss

- *Absent
- +Telecon

# Agenda from November 14, 2016

- **Status of HEOMD**

  Mr. Greg Williams
- **Status of International Space Station**

  Mr. Sam Scimemi
- **Research Subcommittee Update**

  Dr. David Longnecker
- **Status of Human Research**

  Dr. Bill Palowski
- **Status of Commercial Crew Program**

  Ms. Kathy Lueders
- **Status of Exploration Systems Development**

  Mr. Bill Hill

# ISS TOPICS REPORTED AT HEOC MEETING

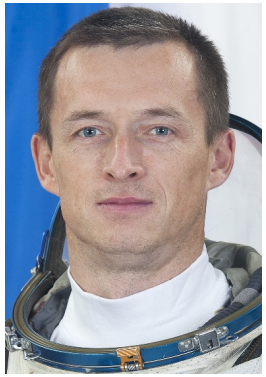
- ISS STATUS
  - CONSUMABLES
  - CURRENT EQUIPMENT STATUS/IN FLIGHT ANOMALIES
- CARGO RESUPPLY ACTIVITY
  - ANTARES RETURN TO FLIGHT
  - PLANS FOR HTV IN DECEMBER
  - CRS 2 CONTRACT/SUPPLIER STATUS
- CASIS ACTIVITY
- ISS INCREMENT ACTIVITIES PLANNED/ACHIEVED
  - EVA PLANS AND ACCOMPLISHMENTS
  - UTILIZATION/RESEARCH PLANS AND ACCOMPLISHMENTS

# Increment 50 Overview: Crew

Shane Kimbrough
FE (US) – 48S
*(CDR Inc 50)*

Andrey Borisenko
FE (R) – 48S

48S Dock 10/21/16
48S Undock TBD



Sergey Ryzhikov
FE (R) – 48S
CDR – 48S


49S Dock 11/19/16
49S Undock TBD


Peggy Whitson
FE (US) – 49S
*(CDR Inc 51)*

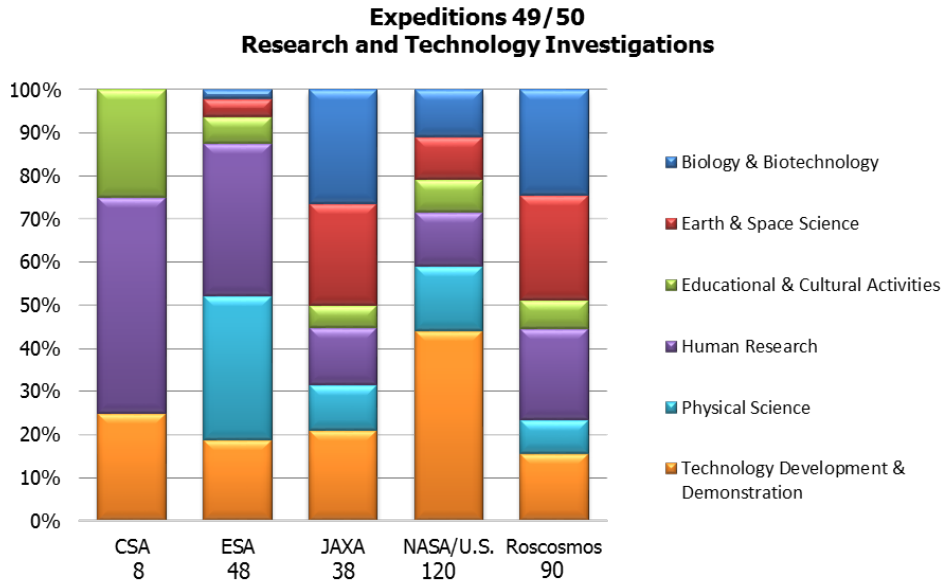
Thomas Pesquet
FE (US) – 49S


Oleg Novitski
FE (R) – 49S CDR

# Number of Investigations for 49/50: 304*

- Record 44.03 avg hours/week of utilization in Inc 47/48

- 120 NASA/U.S.-led investigations
- 184 International-led investigations
- 89 New investigations
  - 2 CSA
  - 11 ESA
  - 11 JAXA
  - 59 NASA/U.S.
  - 6 Roscosmos (Preliminary Data)
- Over 800 Investigators represented
- Over 1300 scientific results publications (Exp 0 – present)




**Estimated Number of Investigations Expedition 0-50: 2276****

**Working data as of Aug 31, 2016*
****Pending Post Increment Adjustments**

# COMMERCIAL CREW PROGRAM REPORT

- **BOTH PROVIDERS MAKING SIGNIFICANT PROGRESS TOWARD FLIGHT**
  - BOEING SCHEDULE FIRST CREW FLIGHT LATE 2018
  - SPACEX SCHEDULE UPDATED AFTER HEOC MEETING – NOT YET AVAILABLE

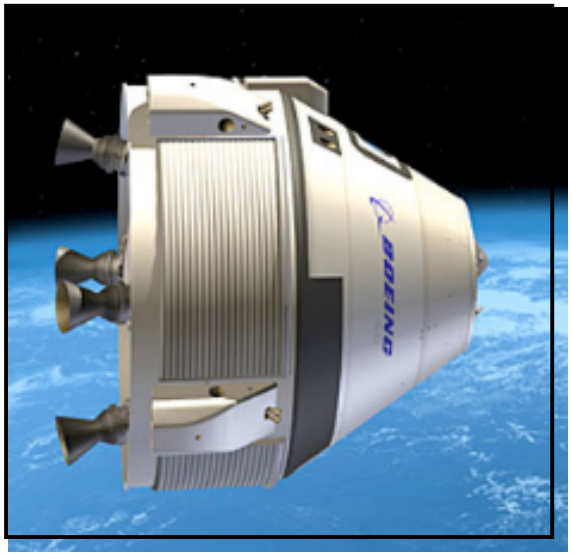
- **SPACEX ANOMALY INVESTIGATION CONTINUING**
  - NASA, USAF, FAA, NTSB ALL REPRESENTED ON INVESTIGATION TEAM
  - NASA INDEPENDENT REVIEW TEAM

- **ASAP REVIEWING DETAILS OF SPACEX PRELAUNCH OPERATIONS**

- **CCP ONLY CARRYING ONE SAFET RISK (MMOD) ALL OTHER RISKS ARE PARTNER PROPRIETARY**
  - ASAP WILL REVIEW – NAC WILL NOT

# Commercial Crew Program Progress & Current Activity

- Successfully completed 2016 Annual Review at Agency level
- Significant progress on the Phase 2 safety review; ~90% of the hazard reports have been delivered for NASA review
- Awarded two operational missions to the ISS for each partner
- Boeing completed mass reduction effort; Crew Access Tower continues to be outfitted at L-41
- SpaceX completed Delta CDR; Pad 39A nearing completion
- Milestone schedules remain optimistic

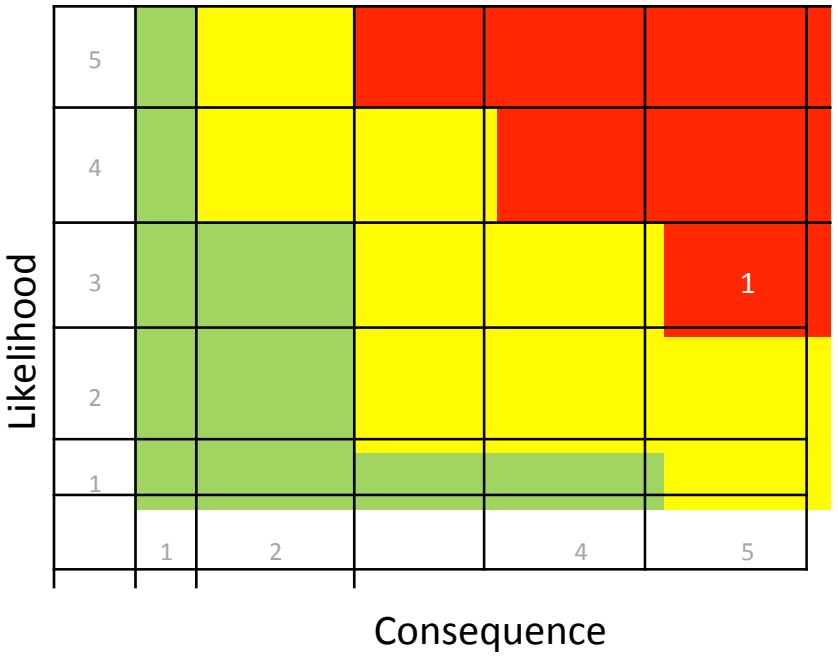



# SpaceX Falcon Anomaly Status

- **During pre-launch static fire operations for Falcon-9 AMOS-6 (F9-29), an anomaly occurred around the second stage that resulted in loss of the vehicle and payload in an explosion on the pad at Space Launch Complex (SLC)-40**
  - Initial indications are that the anomaly initiated around the upper stage liquid oxygen tank
  - Anomaly propagation time was about 35-55 milliseconds
- **SpaceX began its investigation immediately after the loss, consistent with accident investigation plans prepared for such a contingency**
  - An Accident Investigation Team (AIT) was assembled with oversight from the FAA and participation from NASA, the USAF, and NTSB
  - The anomaly investigation team is currently performing testing in Texas and working through the fault tree
  - Leading suspicion is an issue in the cryogenic helium system in the second stage liquid oxygen tank
- **Damage to SLC-40 from the explosion is extensive**
  - SpaceX is focusing on accelerating the readiness of pad 39A at KSC in order to resume F9 launches on the east coast

# CCP Top Program Safety Risks 10/27/27

| LxC | Trend | Risk Title | Risk ID Number | Office |
|---|---|---|---|---|
| 3x5 | NC | Ability to Close the LOC Gap | CCP-SEI-2015-1 | SE&I |

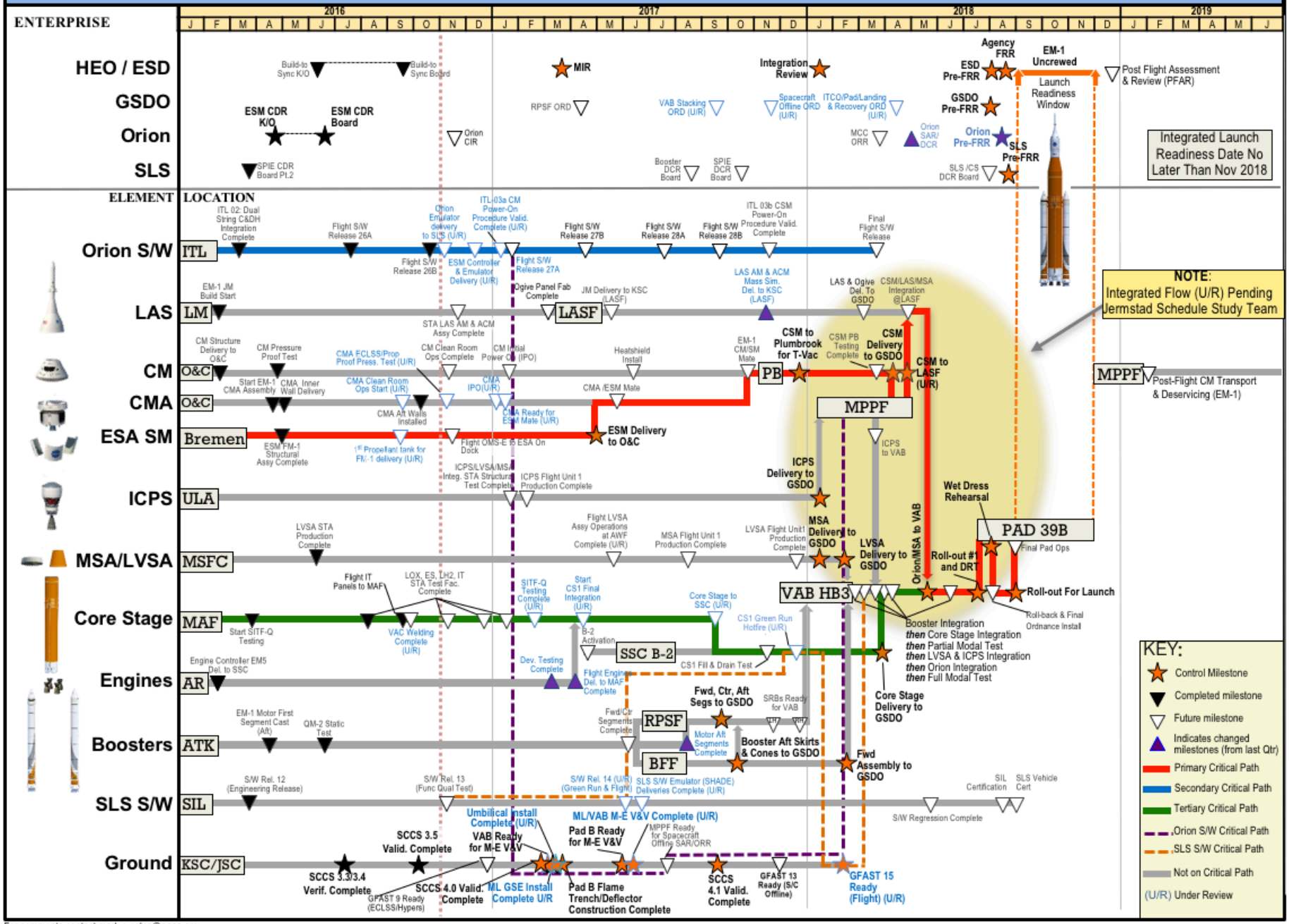


# EXPLORATION SYSTEMS STATUS

- **SIGNIFICANT PROGRESS ON SLS, ORION, AND GROUND SYSTEMS**
  - FUNDING ISSUES STILL CRITICAL
- **TOP ACCOMPLISHMENTS & ISSUES DESCRIBED IN DETAIL FOR HEOC**
  - BUILD TO SYNC REVIEW COMPLETED AT APMC
- **SYSTEMS INTEGRATION REPORT WAS APPRECIATED**
  - EARLIER NAC CONCERN ABOUT THIS TOPIC
- **ARRM ACTIVITY SINCE THE LAST NAC WAS SUMMARIZED**
  - REMAINS ON SCHEDULE
- **LONG RANGE SYSTEMS DEVELOPMENT/TESTING PLAN IS GOOD**
  - NEXT STEP IS THE CIS-LUNAR HABITAT DEVELOPMENT
  - ISS IS CRITICAL TO MICRO GRAVITY OPERATIONS EXPERIENCE, TESTING, CHECKOUT

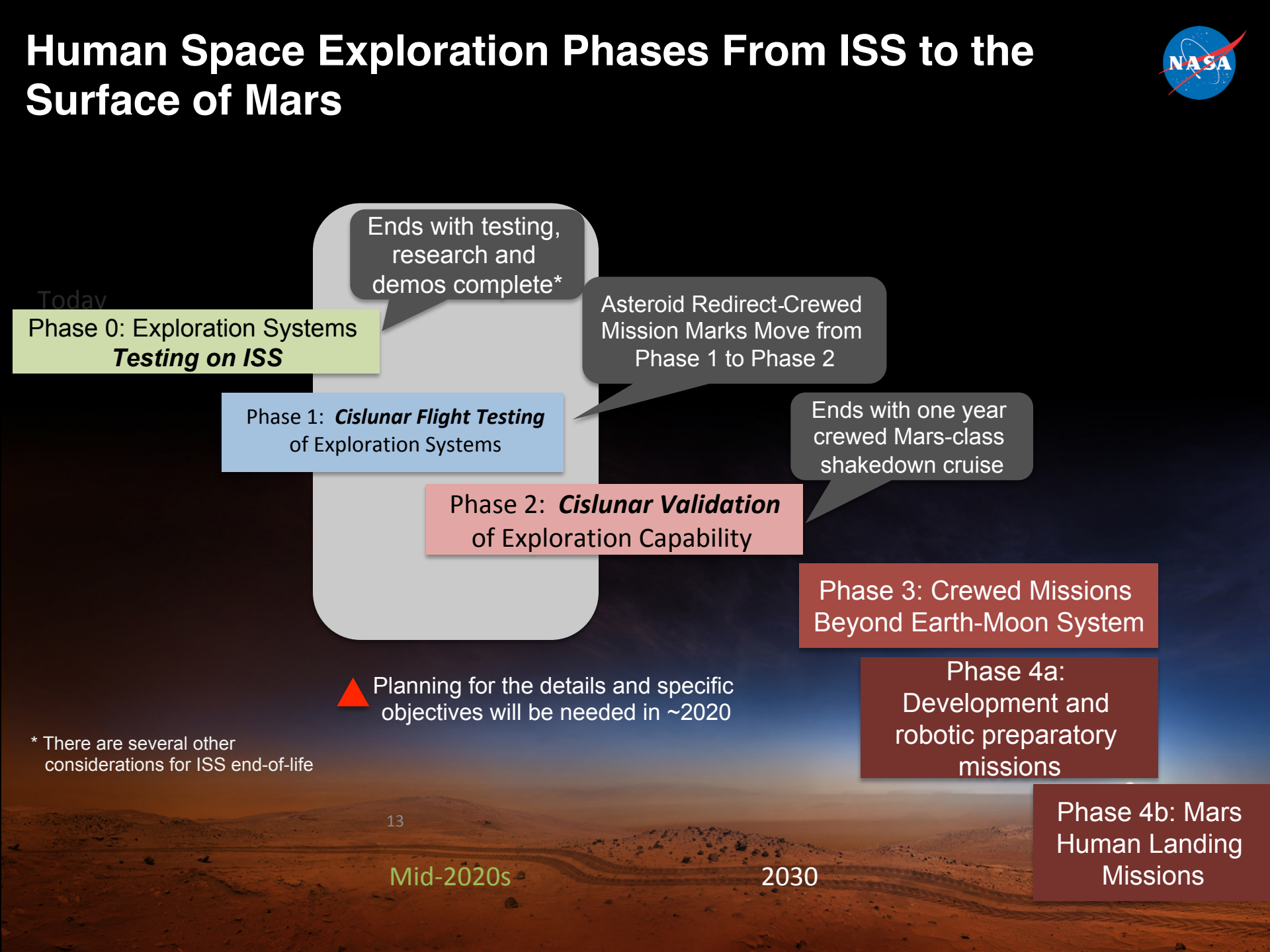
# ESD EM-1 INTEGRATED MISSION MILESTONE SUMMARY

NASA ESD
Chart Updated: 31 October 2016



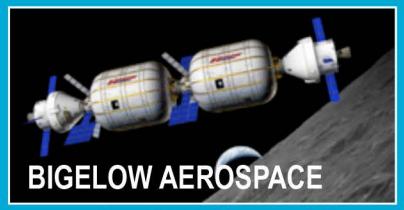

For comments contact mark.e.ogles@nasa.gov

# Human Space Exploration Phases From ISS to the Surface of Mars



# NextSTEP Habitation Overview

## NextSTEP Phase 1: 2015-2016



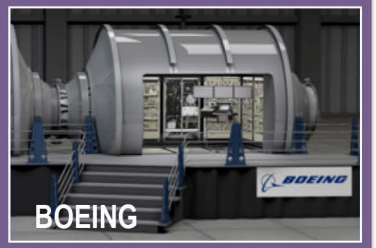

FOUR SIGNIFICANTLY DIFFERENT CONCEPTS RECEIVED

Partners develop required deliverables, including concept descriptions with concept of operations, NextSTEP Phase 2 proposals, and statements of work.

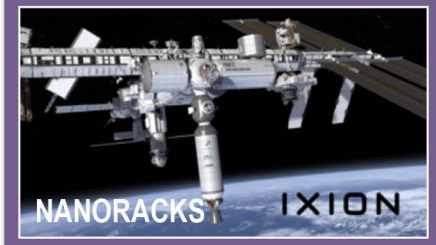
## NextSTEP Phase 2: 2016-2018




FIVE GROUND PROTOTYPES BY 2018


ONE CONCEPT STUDY




Define reference habitat architecture in preparation for Phase 3.

## Phase 3: 2018+

# HEOC CONCLUSIONS
# (no Findings or Recommendations)

- **THE CURRENT NASA PLANS ARE ON TRACK AND REPRESENT A GOOD PLAN GIVEN CURRENT BUDGET AND ADMINISTRATION GOALS**

- **NASA SHOULD PARTNER WITH FAA/AST AND ASTM DEVELOPING STANDARDS FOR SPACE FLIGHT**

- **PUBLIC/PRIVATE PARTNERSHIPS ARE BEING INCREASINGLY UTILIZED**
  - HOWEVER, DEVELOPMENT ON A FIRM FIXED PRICE SERVICES CONTRACT ARRANGEMENT IS PROBLEMATIC, AS SHOWN WITH CURRENT PROJECTS

- **MUCH DISCUSSION ABOUT THE NEW ADMINISTRATION/TRANSITION**
  - CRYSTAL BALL IS CLOUDY AT THIS POINT
  - HEOC IS NOT READY TO PROPOSE SIGNFICANT COURSE CHANGES

## FINDINGS FROM JULY MEETING

# BACKUP

# HEOC Finding on Current NASA Status

- **Finding:** The HEOC commends the NASA Advisory Council and outgoing Chairman Dr. Stephen Squires for their commitment, leadership, and pertinent recommendations over the last several years. The deliberations of the NAC will continue to be essential for NASA as changes will likely follow the national elections in November 2016.
- The HEOC supports the current systematic approach to the ultimate goal of human exploration of Mars that is guided by the three domains of NASA's "Journey to Mars" strategy, which builds sequentially from Earth dependent to proving ground to Earth independent.
- We commend the leadership and staff of NASA HQ and the Centers for the steady progress being made on ISS, Commercial Crew, Orion, and SLS.

# HEOC Finding Concerning Soyuz Transportation

- **Finding:** HEOC is concerned about the possibility of a gap in ISS transportation for NASA crew. The current schedules of both Commercial Crew Program (CCP) providers show completion of certification in time to allow for crew rotation to ISS in CY2018, however there is very little margin. Human spaceflight development programs invariably suffer schedule slips due to their technical complexity; the integration of commercial providers into government service adds further obstacles to CCP.
- It is therefore prudent to assume delays in post-certification missions from today's schedule. Since NASA has purchased Soyuz seats only through CY2018, any delay of CCP operational capability beyond CY2018 will result in the inability to send NASA astronauts to ISS until one of the CCP providers can complete certification.
- Due to long lead time required to procure Soyuz seats, a decision must be made by the end of CY2016 to guarantee access to ISS in CY2019, or NASA may be forced to reduce – or possibly eliminate – its crew complement aboard ISS.

# HEOC Finding on Technology Development and Mars Architecture

- **FINDING:** The overall architecture for "Journey to Mars" has matured to the point that allows effective focus on the next steps to successfully meeting the goal of humans exploring Mars. A sound detailed architecture through the next ten years to allow adequate definition of technology development requirements.

- To ensure time and money are effectively utilized toward the "Journey to Mars" campaign:
  - Continue to review, identify, and refine the technology needs. Then the schedule should be developed for implementation in a timely manner.
  - Develop schedules and implementation of development of elements for Phases 1&2 of the campaign to ensure NASA R&D is positioned to efficiently accomplish Phases 3&4.
  - Determine the schedule and programatics of the technology development campaign.

# Observations from HEOMD Presentations

- HEOMD has added detail to plans for human exploration missions in the 2020's to identify near term technology development requirements.

- ISS test bed for technology development for deep space exploration is critical and good definition has been made on identifying priorities and critical work to be accomplished during ISS operational lifetime.

- Continued progress is being made on Commercial Crew, SLS, and Orion with no major schedule adjustments due to technical or resource issues.

- ARM planning and development is continuing. The Formulation and Assessment Team's report has been very helpful. Engagement with the Small Body Assessment Group has improved science potential. Planetary defense objectives have been included.

# Top Concerns

•Bureaucratic processes that NASA imposes on itself do not always add value to balance their load on the organization and are a threat to accomplishment of NASA's exploration mission.

•The number and intensity of current reviews of the HEO programs are not helpful and use too many precious resources. The IG and GAO should coordinate and prioritize their reviews.

•Low SLS and Orion Launch rate pose future risks for proficiency of the operations team and reduce program resilience in the event of mission failure

•Budget uncertainty and reduced flexibility in funding accounts make it more difficult than ever for program managers to meet technical and schedule objectives.